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| **Question &**  **Key Area** | **Marking Instructions** | **Marks** |
| 1 | more collisions with energy greater or equal to Ea  or  more collisions leading to an activated complex  or  correct energy distribution diagram | 1 |
| 2 | **(a**) increases (or gets bigger or rises)  **(b)** more energy is needed to remove the electron from a full shell (or complete shell or noble gas shell)  **or** an electron is being removed from an energy level closer to the nucleus  **or** there is a greater nuclear pull on the electron being removed  **or** second energy level is nearer the nucleus  **or** second energy level is full (or complete), etc.  **(c)** forces of attraction between molecules (or intermolecular forces or van der Waals’/London forces) increase  **or** energy needed to separate the molecules increases. | 1  1  1 |
| 3 | a)  Stating that one (CHCl3) is polar **and/or** the other (CCl4) is non-polar **(1)**  Identifying that CHCl3 has permanent dipole/permanent dipole attractions **and** identifying that CCl4 has London dispersion forces **(1)**    Other mark is for a statement linking intermolecular forces/polarity to the solubility in water. Statements such as the following would be acceptable   Water is polar **(1)**   Water has permanent dipole/ permanent dipole attractions **(1)**   Water is a good solvent for polar molecules **(1)**   Like dissolves like **(1)**  b)   |  |  | | --- | --- | | -97 (2) |  | | A single mark is available if either of the following operations is correctly executed | | | **Either** | | | the four relevant values for the bond enthalpies of the C–H, Cl–Cl, C–Cl and H–Cl bonds (or multiples thereof) are retrieved from the databook; 243, 414, 326, 428 (ignore signs) **(1)** | | | **or** | | | the enthalpy values for bond formation are taken away from the enthalpy values for bond breaking without arithmetic error **(1)** (units not required) | | | Total: 3  Total: 2 |
| 4 | a) terpenes  b) i)3,7-dimethylocta-1,6-dien-3-ol  ii) Hydroxyl is attached to carbon which is attached to 3 other carbons  (or hydroxyl is attached to a C that has no H atoms attached) | 1  1  1 |
| 5 | a) Kill bacteria/Fungi/Inactivate Viruses  b) i)  3 points ( **1 mark each** ) from −  **1 mark** for preparation of burette – rinse the burette with the thiosulfate solution  rinse the burette with the solution to be put in it / with the solution  **2 marks (1 mark each)** for any 2 of the following points   fill burette above the scale with thiosulfate solution   filter funnel used should be removed   tap opened/some solution drained to ensure no air bubbles   (thiosulfate) solution run into scale   reading should be made from bottom of meniscus  b) ii) 2I−(aq) 🡪 I2(aq) +2e (ignore state symbols)  c) i)  **1 mark** Ammonia is polar molecule and trichloramine is non-polar molecule.  **1 mark** Explanation of this in terms of polarities of bonds or electronegativity differences of atoms in bonds  ii) Substances with unpaired electrons  iii) Propagation | 1  Total: 3  1  Total:  2  1  1 |
| 6 | a) i) Pentan-1-ol (pentanol is **not** acceptable)  ii)  (Zero marks if a covalent bond is drawn between Na and O. Charges not required but if shown they **both** must be correct. Shortened structural formula also accepted)  b) i) ester  ii) Soap (also accept emulsifier or detergent) | 1  1  1  1 |
| 7 | a)  –803, 726, 283  (any two values from this list) **(1)**  +206 kJ mol–1 (for value, no follow through, units not required) **(1)**    b) | Total: 2  1 |
| 8 | a) Glycerol/propane-1,2,3-triol  b) Waterbath/Heating mantle (**not** Bunsen burner)  c)= 24·8/25% (2 marks)  Calculates the theoretical yield of soap (= 5·16g )  OR  correctly calculates the number of moles of  reactant (= 0·00566) **and** product (= 0·00421)  [1·28/304] (1 mark)  Calculating the % yield; either using the actual and  theoretical masses, or using the actual number of  moles of products and actual number of moles of  reactant (1 mark)  **Not acceptable for %**  **yield mark to use**  **1·28/5 or 3 x 1·28/5.**  d) 90.8% (2 marks)  Partial Marking (3x304)/884+(3x40) 1 mark | 1  1  Total 2  Total  2 |
|  | 18 cm3 /0·018 litres **with correct unit** 3 marks  Partial marking:  1 mark can be awarded for two of the three steps shown below correctly calculated:  1. number of moles of H2O2  2. mole ratio applied  3. calculated number of moles of O2 multiplied by 24 (24000)  If processed by proportion 68 g 🡪 24 l (24000 cm3 ) 1 mark  OR 0.051 g 🡪 0.036 l (36 cm3 ) 1 mark  1 mark for correct units.  b)i) amino acids  ii) A) Amide/Amide link/Peptide link  ii) B) any one of the following    iii) A) denaturing  iii) B) Temperature increase/pH  (Temperature on its own is **not** acceptable. High/higher/above optimum temperature also accepted) | Total 3  1  1  1  1  1 |
| 10 | a) Water  b)  Correctly calculates number of moles of: Benzoic acid = 0·041 Methanol = 0·078.  OR  Working out that 1∙31 g of methanol would be needed to react with 5 g of benzoic acid.  OR  Working out that 9·53 g of benzoic acid would be needed to react with 2·5 g of methanol. (1)  Statement demonstrating understanding of limiting reactant  eg there are less moles of benzoic acid therefore it is the limiting reactant.  OR  here are more moles of methanol therefore it is in excess.  OR  0·078 moles of methanol would require 0·078 moles of benzoic acid. (1)  c) (£)12·84 (2)  Partial Marks  Mass benzoic acid = 161·3(g).  OR  Cost to make 3·1g of methyl benzoate = (£) 0·398.  OR  Evidence of a calculated mass of benzoic acid × 7·96 or 8 (p). (1)  *(Accept 1284 p. Do not accept ‘1284’ on its own; correct units are required. Allow follow through from an initial arithmetic error (for 1 mark). Rounding of final answer to the nearest penny is required.)* | 1  Total 2  Total 2 |
| 11 | a) Thermometer touching bottom or directly above flame or temperature rise recorded would be greater than expected.  b)Distance between flame and beaker or Height of wick in burner Same type of beaker (this needs to be qualified) Same draught proofing  c) 2 concept marks + 1 arithmetic mark  Concept marks Demonstration of the correct use of the relationship Eh=cmΔT (1) eg 4·18 × 0·1 × 23  or  9·61  and  Knowledge that enthalpy of combustion relates to 1 mol (1) evidenced by scaling up of energy released  Correct arithmetic = −288 kJ mol−1 (1)  (Maximum of 2 marks can be awarded if negative enthalpy sign is not shown in final answer.) | 1  1  Total 3 |